OPALCO

IRP Update - September 2019

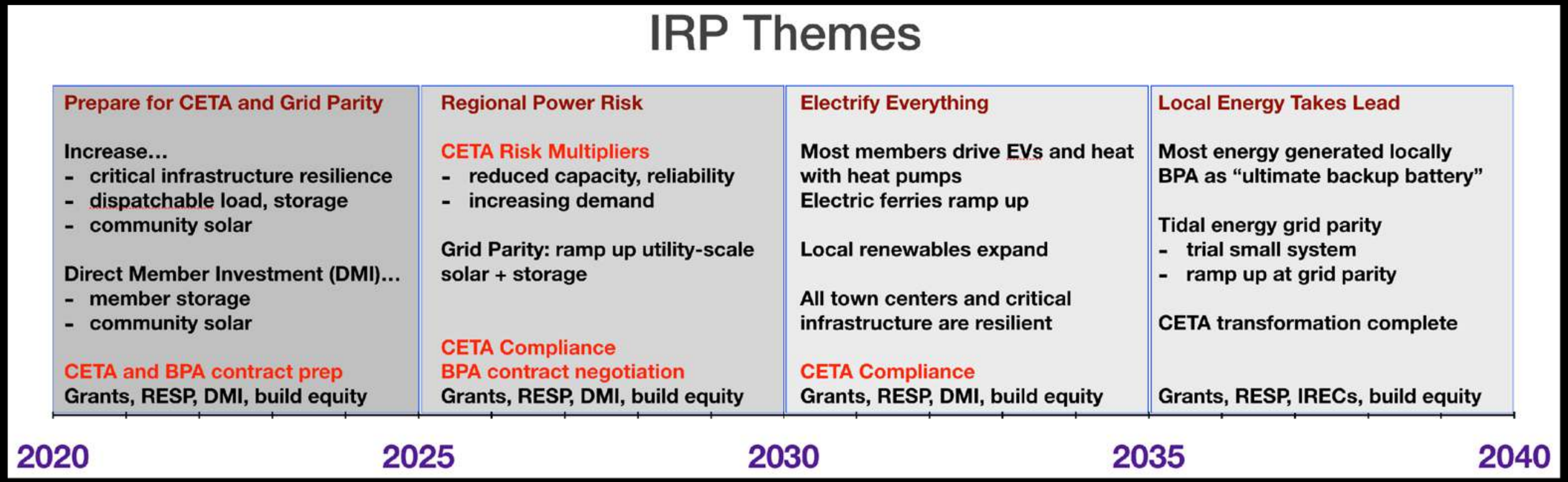
IRP Planning Roadmap

	Date	Activity
✓	February 2018	Strategic Long-Range Vision
✓	March 2018	Long-Range Capital Projects Work Session
✓	May 2018	Long-Range Financial Work Session (equity, cash, debt)
✓	August 2018	Cost of Service Analysis (COSA)
✓	September 2018	Rate Structure Review (supporting COSA)
✓	October 2018	Rate Structure Approval
✓	Q2 – Q3 2019	Update Integrated Resource Plan (IRP) to 2020 - 2040
✓	August 2019	Review draft IRP
✓	September 2019	Approve final IRP
	Q1 2020	Review final Long Range Capital Plan (LRCP)
	Q2 2020	Review Long Range Financial Plan (LRFP)
	Q3 2020	Review Long Range Member Communications Plan (LRMCP)

IRP Updates From August Draft

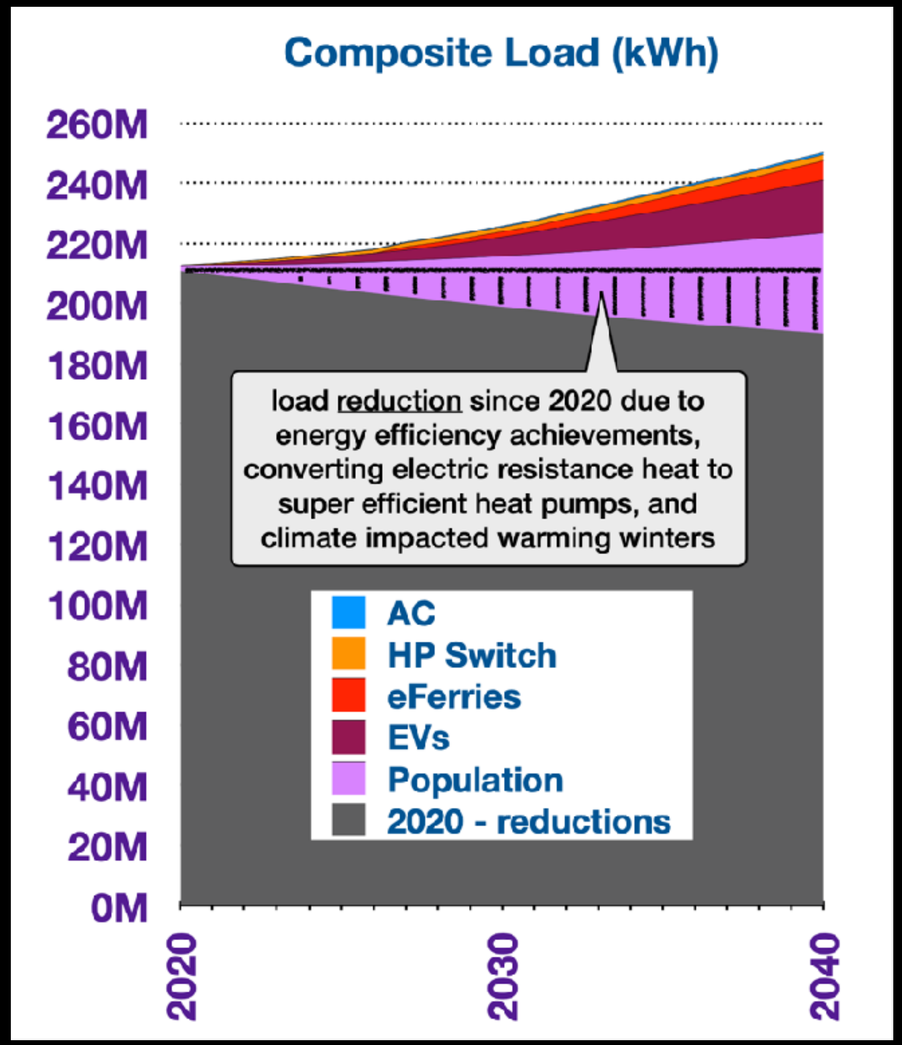
IRP Update Highlights: Exec Briefing

- Steady gradual incremental change, until grid parity
- Demand will exceed supply, especially in high demand periods
- Mainland power is essential vital resource for foreseeable future, tapering to about half in 2040
- Near-term emphasis on member collaboration developing local energy resources
- Balancing Exchange linking together BPA, PNGC, OPALCO utility scale, members energy resources, leading with lowest cost local when possible, using mainland power as ultimate backup battery
- Synergy of efficiency, broadband, and IoT (Internet of Things)

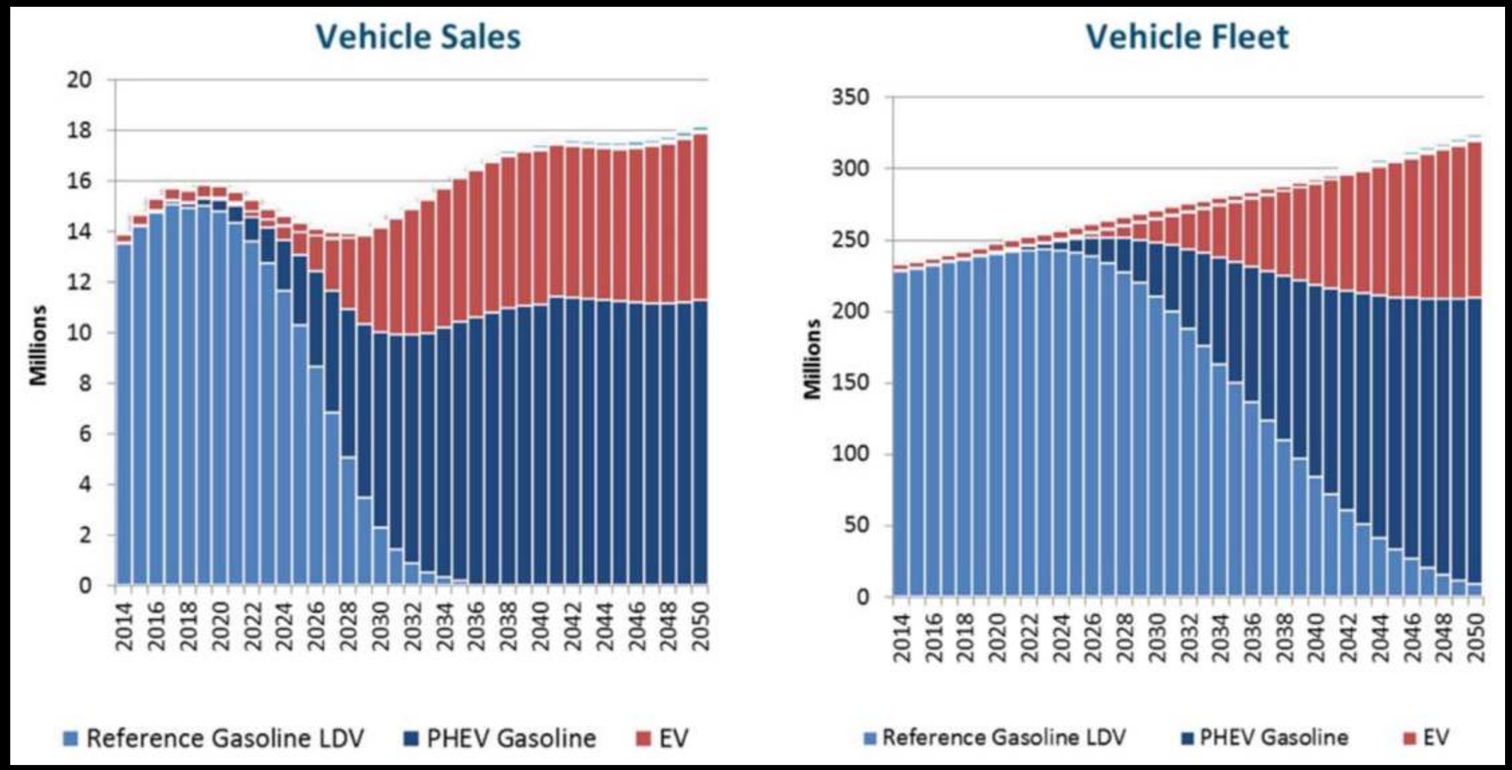


IRP Update Highlights: Load

Load Reduction Drivers



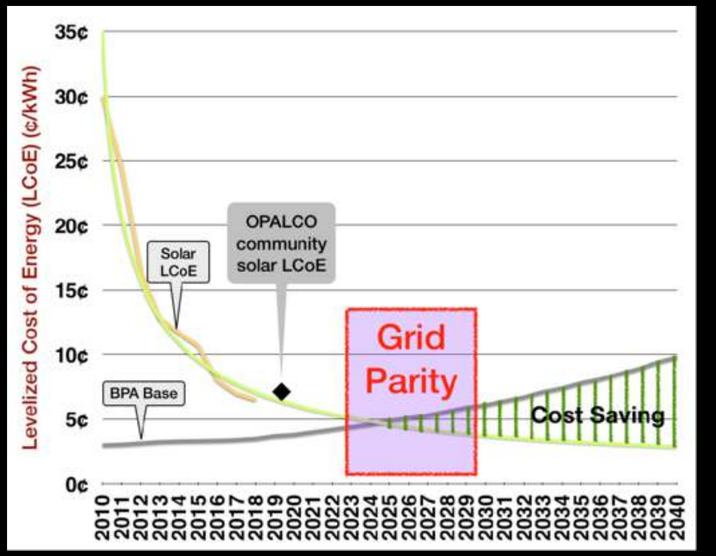
EVs = PHEV + BEV



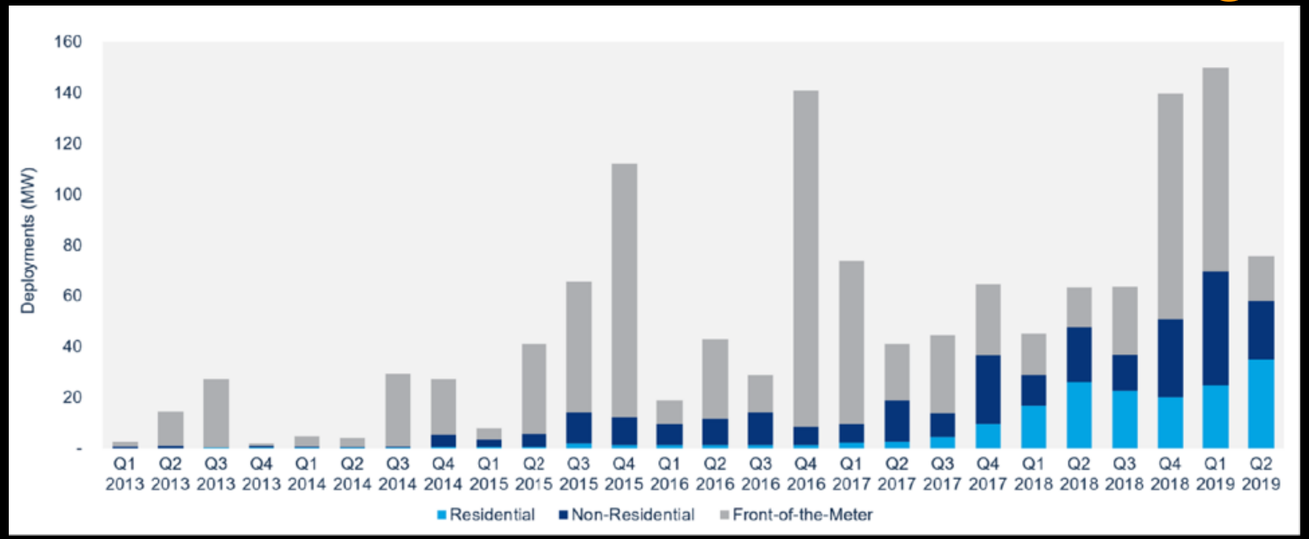
IRP Update Highlights: Energy Resources

- Deepen CETA discussion and added NW capacity shortfall chart
- Additional grid parity chart showing cost savings
- Added more material on dispatchable storage case study, and info on Virtual Peaker for distributed resource dispatch
- Added Biomass section

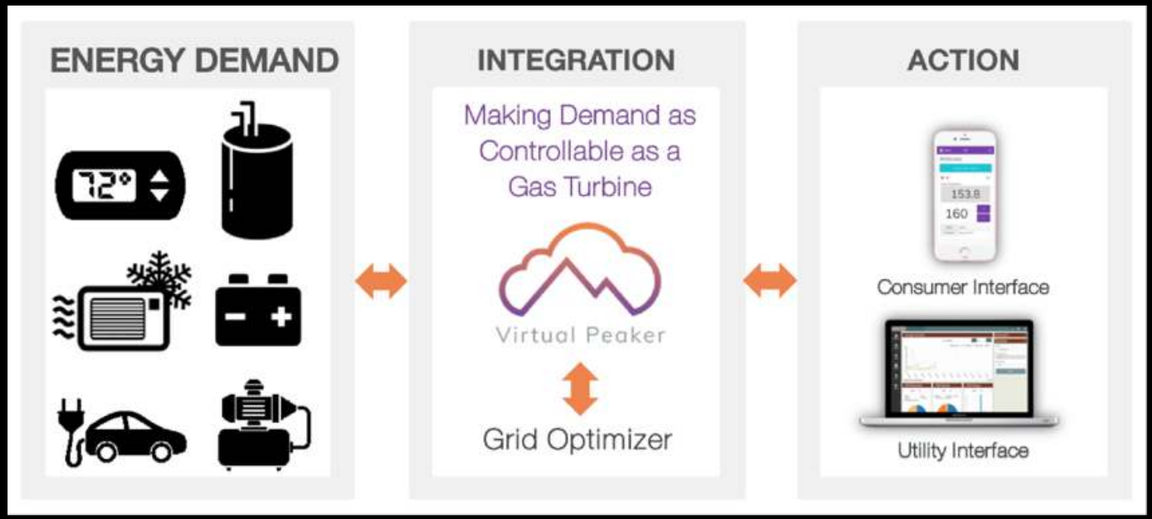
Grid Parity



Home Storage



Virtual Peaker

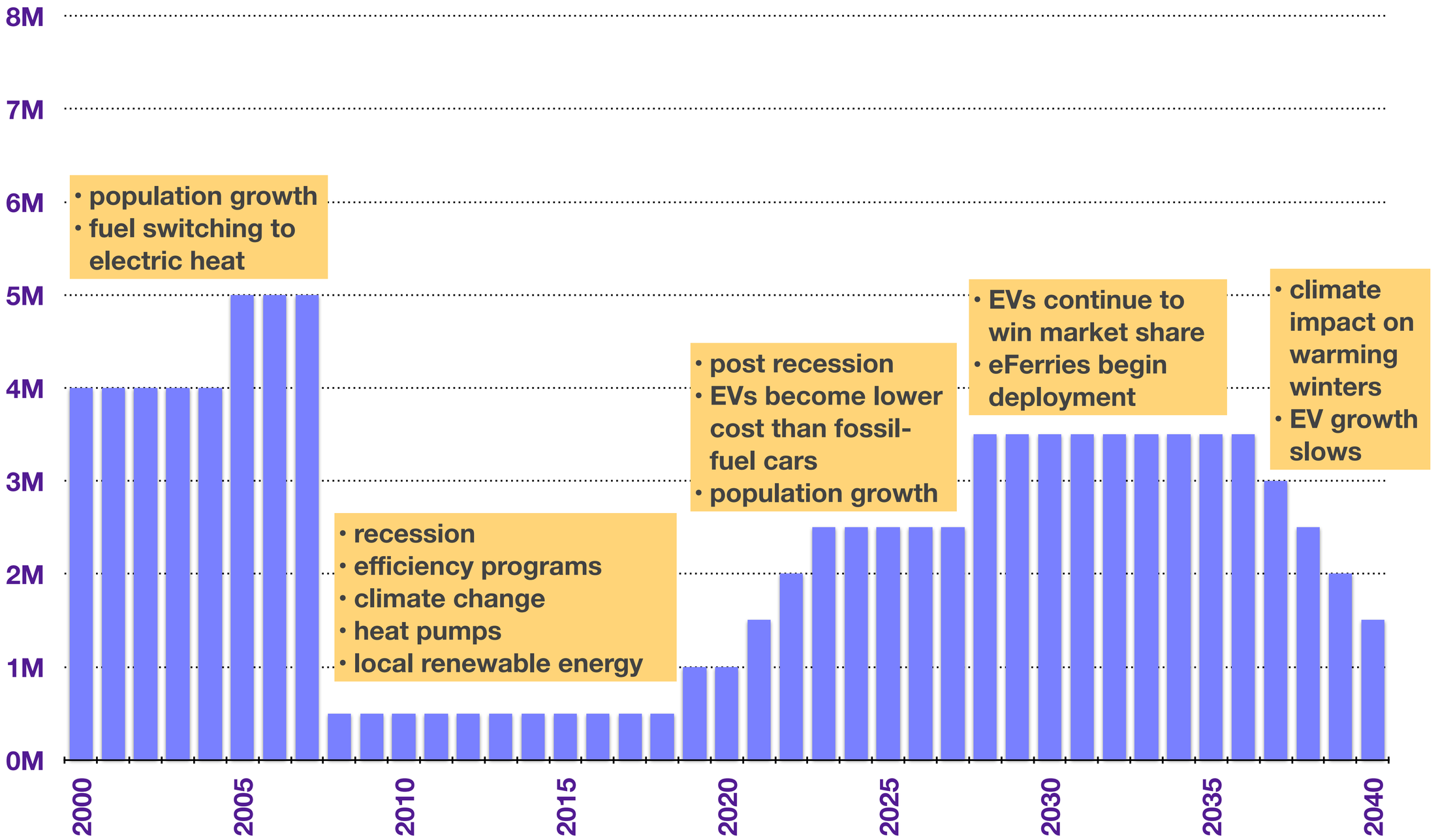


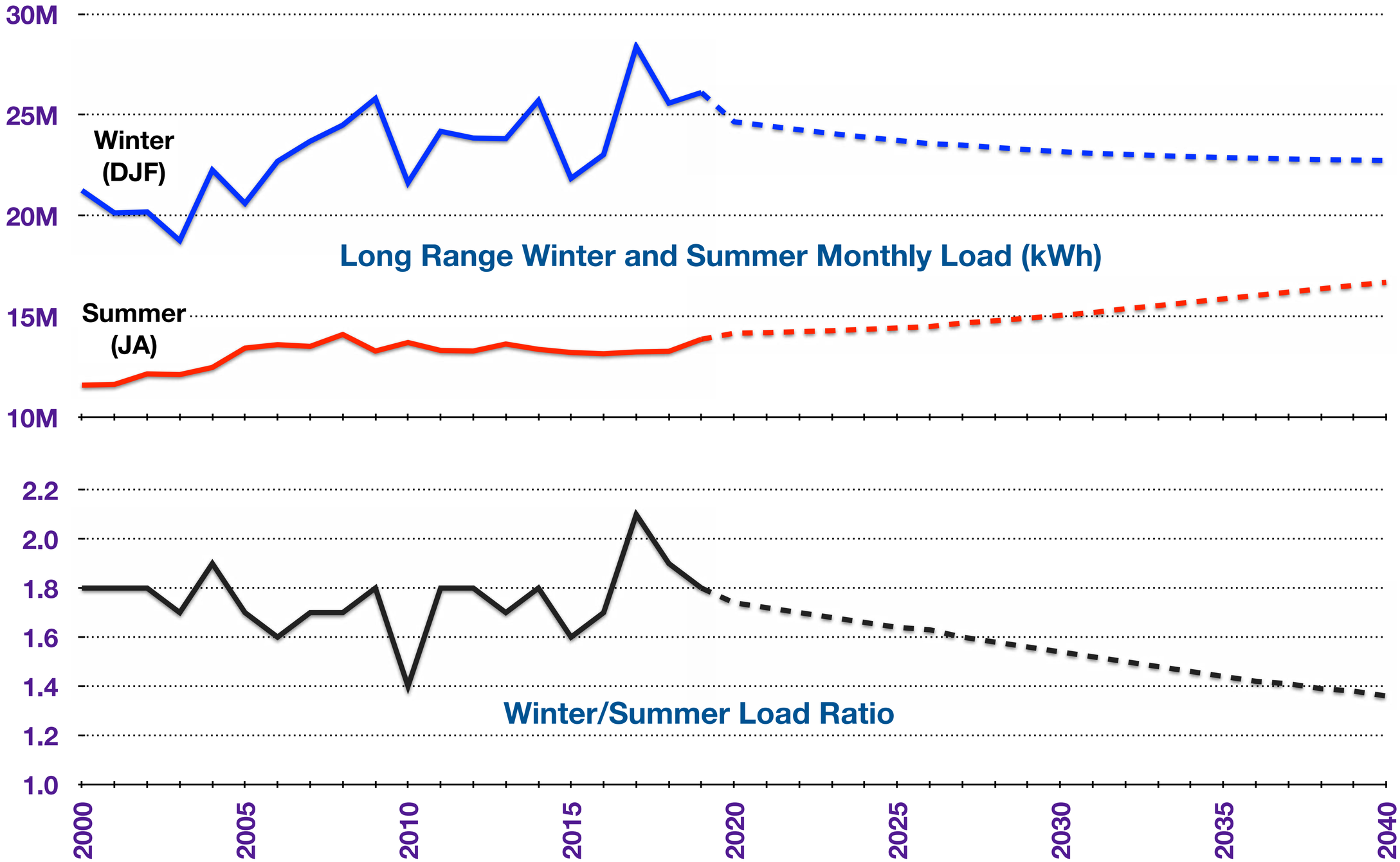
IRP Update Highlights: Partners

- PNGC thoughts
- Highlight CETA assistance, helping offload OPALCO staff time to navigate CETA requirements, rules and regulations

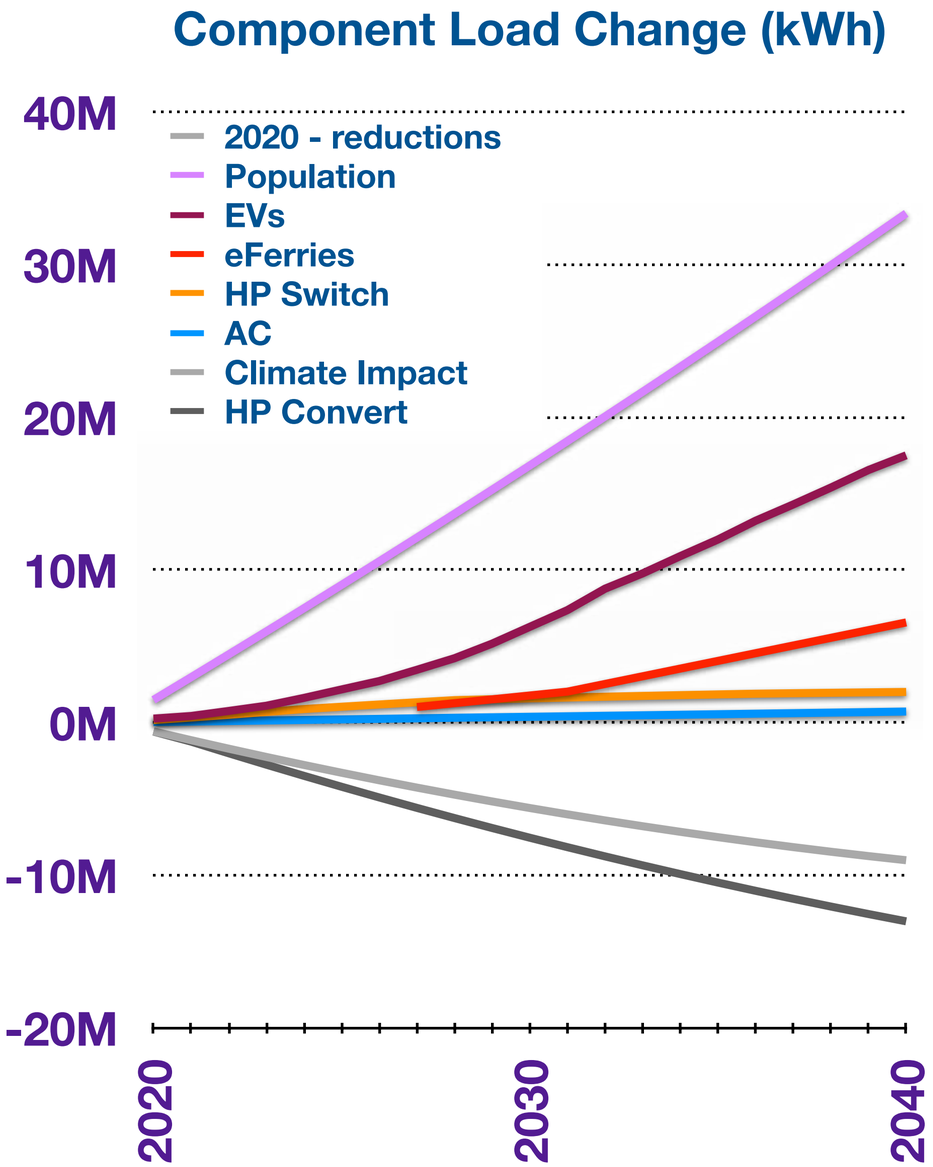
IRP Load Section

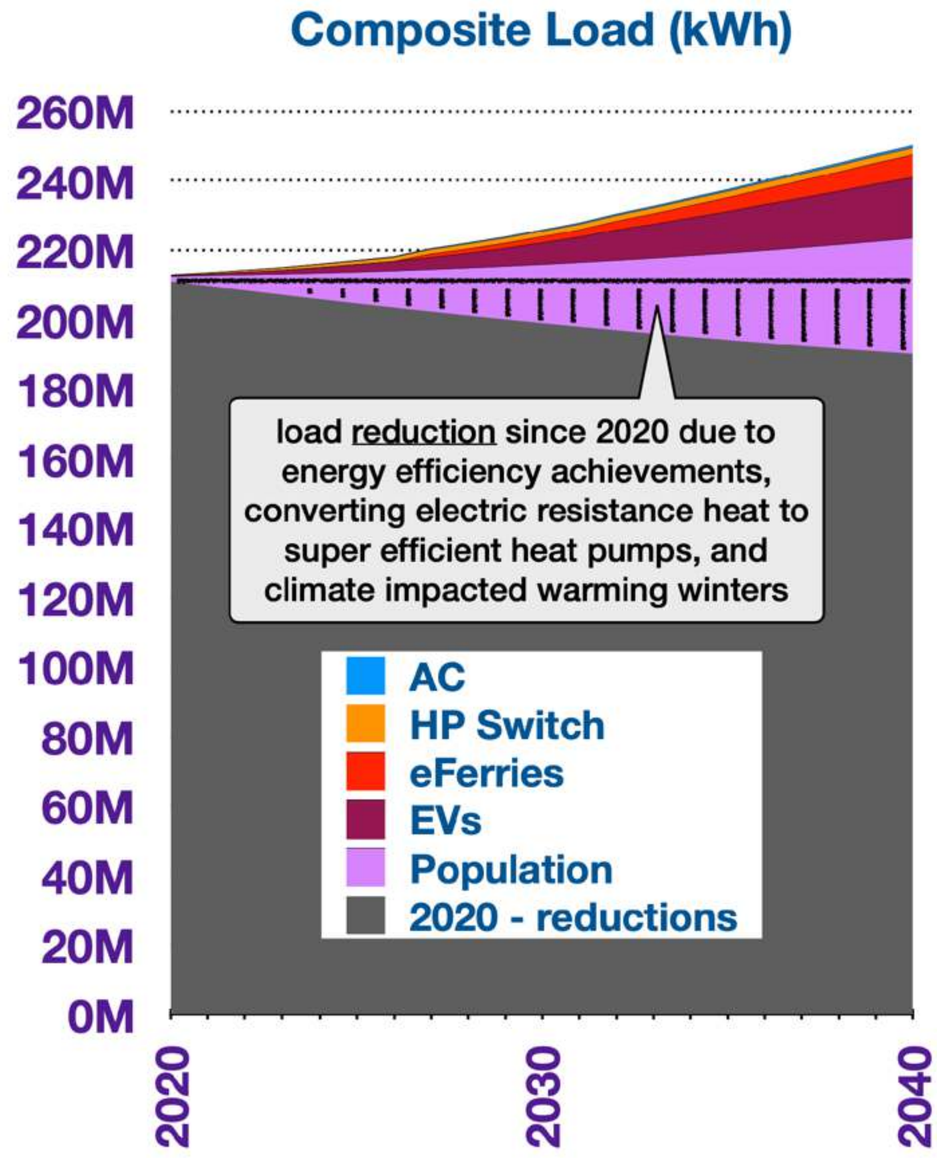
OPALCO Representational Annual Load Growth (kWh) and Drivers Impacting Load




30M
25M
20M
Winter
(DJF)
Long Range Winter and Summer Monthly Load (kWh)
15M
Summer
(JA)
10M
2.2
2.0
1.8
1.6
1.4
1.2
1.0
Winter/Summer Load Ratio
2000
2005
2010
2015
2020
2025
2030
2035
2040

population + EVs + eFerries + fuel switching + AC - efficiency - climate reduced heating





IRP Resource Section

Impact of Capacity Shortages

The problem is two-fold

1. Mainland is reducing capacity
2. No plan (or funding) to replace it

Impact of Capacity Shortages

Action

- Increased hunger for climate friendly hydro, especially in California
- CETA
- Decommissioning coal/ nuke plants
- Potential dam removal

=

Reaction

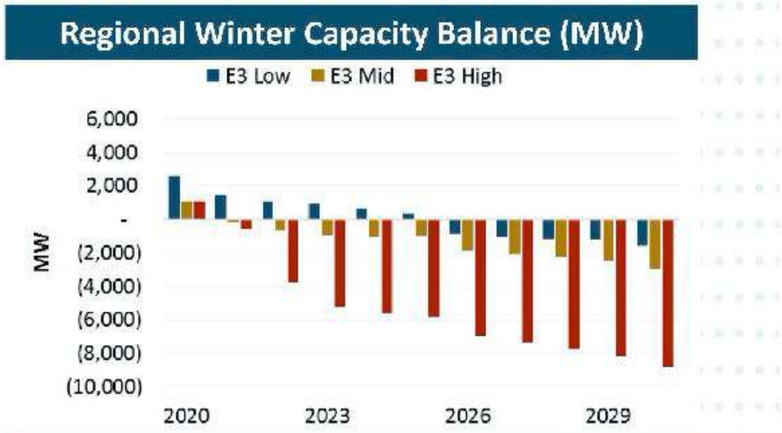
- Reducing Capacity
- Demand Charge increases
- Energy cost increases
- Brownouts
- Rolling Blackouts

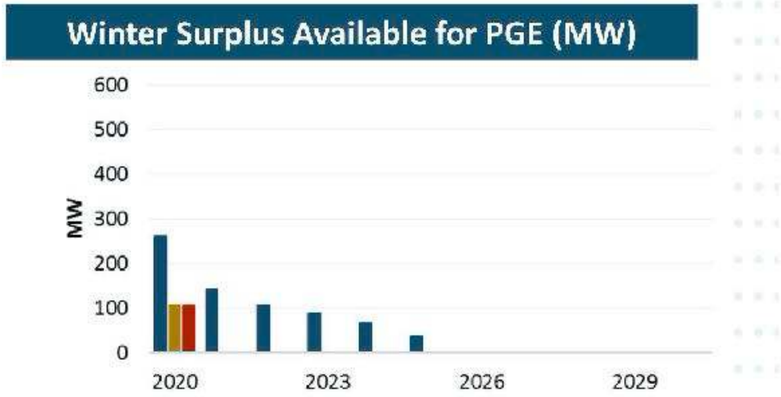
Impact of Capacity Shortages: Capacity Challenges Before CETA

Drivers Increasing peak loads • coal plant retirements • few thermal power plants expected to be built in the coming years

Net Capacity Position
Winter

- **Except for the Low need scenario, the region is capacity short in the winter starting in 2021**
  - No market surplus available for PGE if region is net short
- **For the Low need scenario, surplus capacity is available through 2025**





Energy+Environmental Economics

Source: E3 Consulting 10/2018 PGE Load Resource Balance Analysis

Potential CETA Impact: Capacity Challenges Before CETA

Drivers Increasing peak loads • coal plant retirements • few thermal power plants expected to be built in the coming years

Winter

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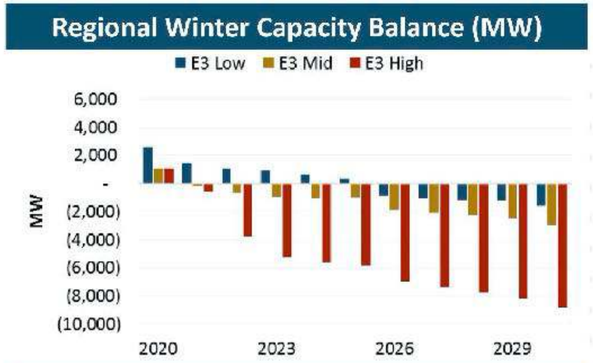
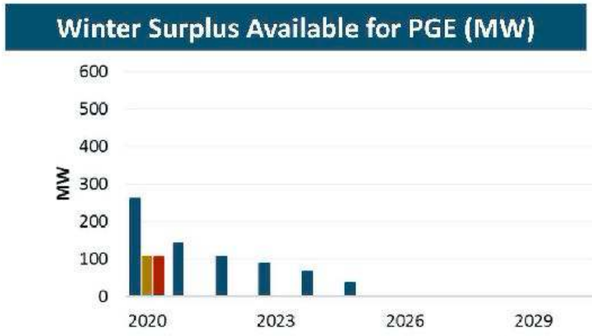


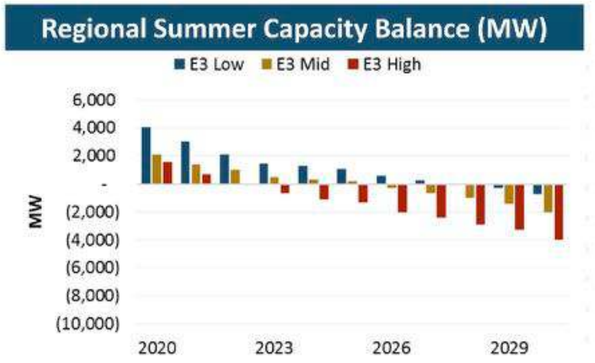


Energy+Environmental Economics

Summer

Net Capacity Position
Summer

- **Region has surplus summer capacity through 2022 for all scenarios**
- **For the High need scenario, no market surplus capacity is available starting in 2023, whereas for the Base scenario, a small market surplus is available through 2025**



Energy+Environmental Economics

Source: E3 Consulting 10/2018 PGE Load Resource Balance Analysis

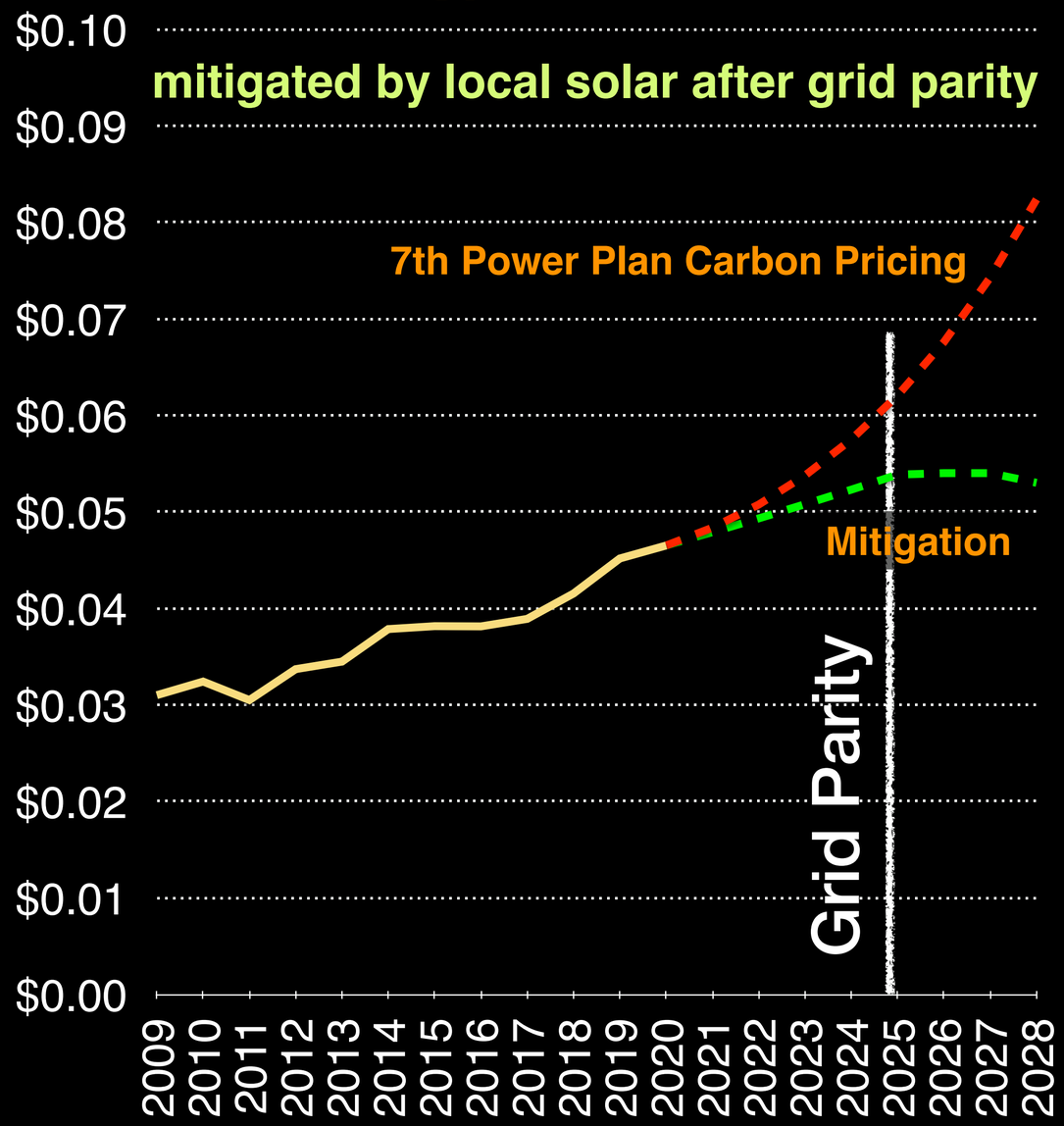
Two Kinds of Cost

Direct Cost of Power

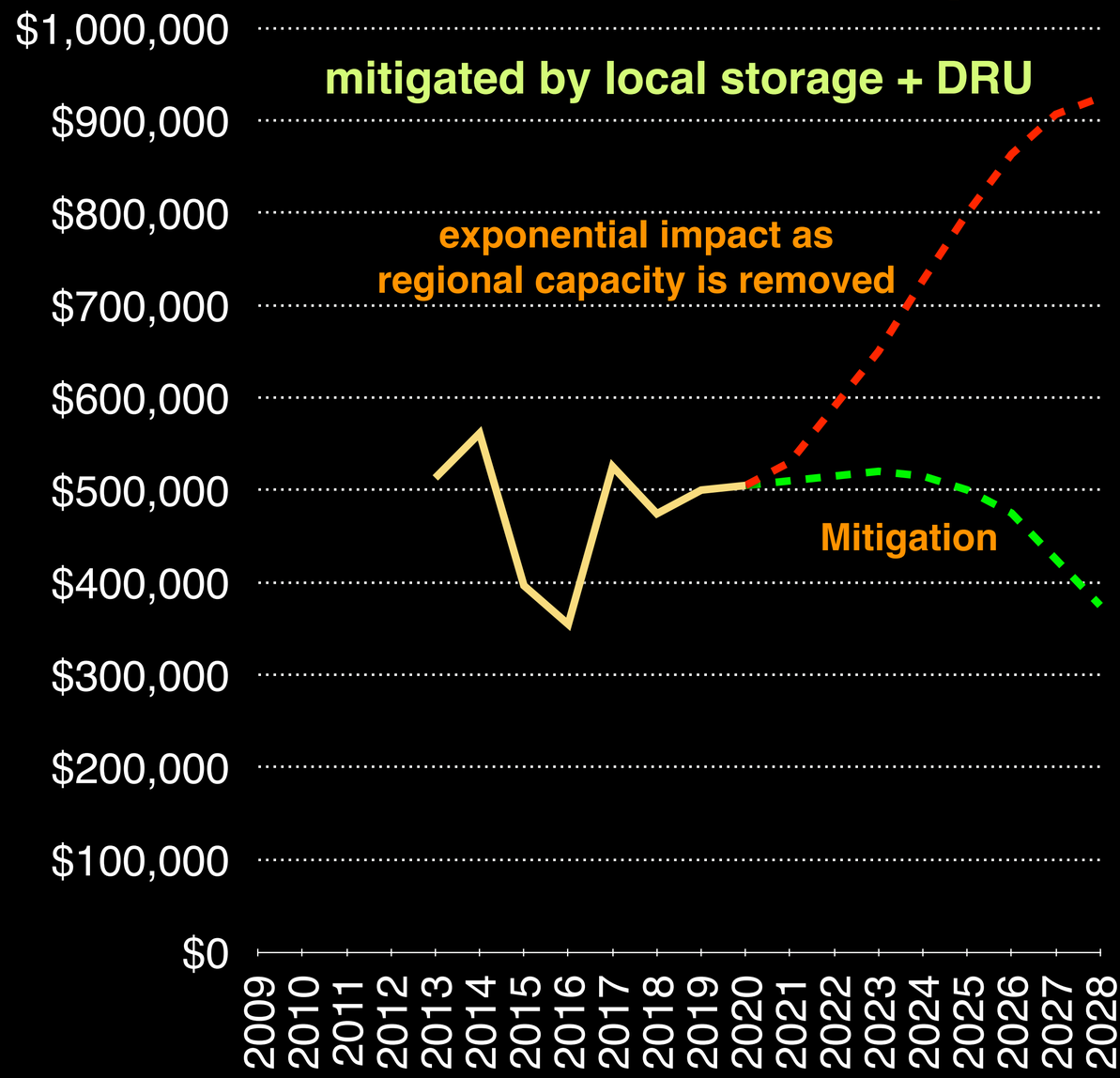
Indirect Cost of Outages

Potential Impact of Capacity Shortages: Cost of Power

Energy Cost ($/kWh)



Annual Demand Charges



Source: E3 Consulting 10/2018 PGE Load Resource Balance Analysis

IRP Themes

2020–2025	2025–2030	2030–2035	2035–2040
Prepare for CETA and Grid Parity Increase… - critical infrastructure resilience - dispatchable load, storage - community solar Direct Member Investment (DMI)… - member storage - community solar CETA and BPA contract prep Grants, RESP, DMI, build equity	**Regional Power Risk** CETA Risk Multipliers - reduced capacity, reliability - increasing demand Grid Parity: ramp up utility-scale solar + storage CETA Compliance BPA contract negotiation Grants, RESP, DMI, build equity	**Electrify Everything** Most members drive EVs and heat with heat pumps Electric ferries ramp up Local renewables expand All town centers and critical infrastructure are resilient CETA Compliance Grants, RESP, DMI, build equity	**Local Energy Takes Lead** Most energy generated locally BPA as “ultimate backup battery” Tidal energy grid parity - trial small system - ramp up at grid parity CETA transformation complete Grants, RESP, IRECs, build equity

Interruption Cost Estimator (ICE): Outage Cost Analysis

Members	Meters	Typical Outage Event Cost	Value of 30% Reliability Improvements
Residential	13,200	$217,958	$1,030,287
Commercial	1,900	$6,381,581	$37,326,937
Total	15,100	$6,599,538	$38,357,224
Notes		Typical February outage event: SAIFI = 1.74 SAIDI = 358	Project start: 2020 Inflation: 2% Asset Life: 25 yrs Discount Rate: 6% SAIFI = 1.4 SAIDI = 240

Source: DOE ICE

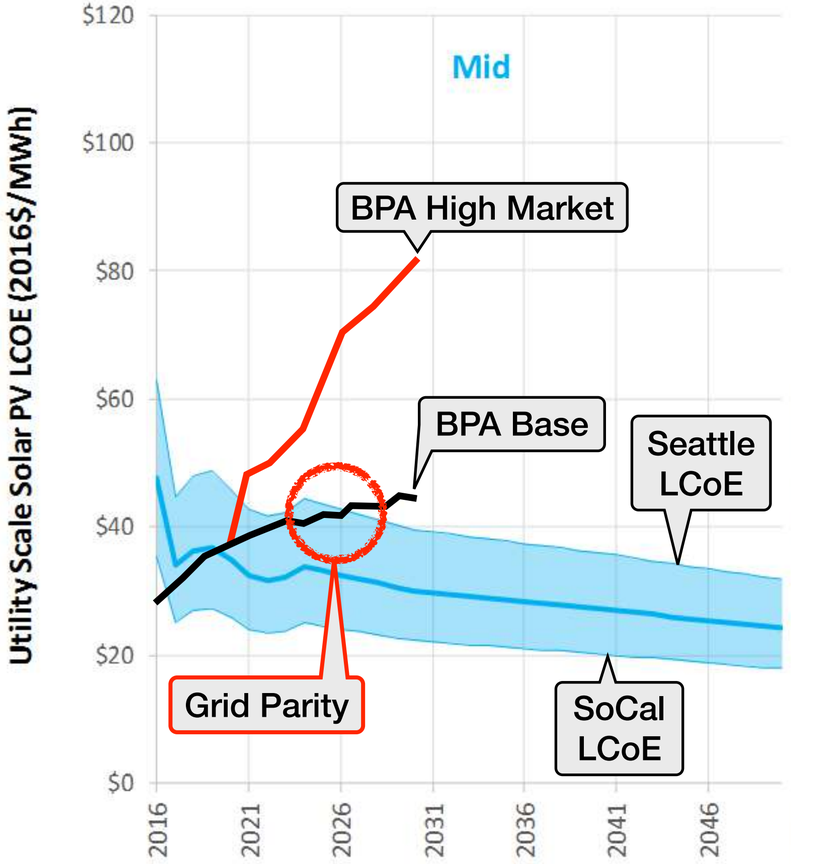
Resource Mix

What resources do we need to help mitigate mainland outages and rising energy costs?

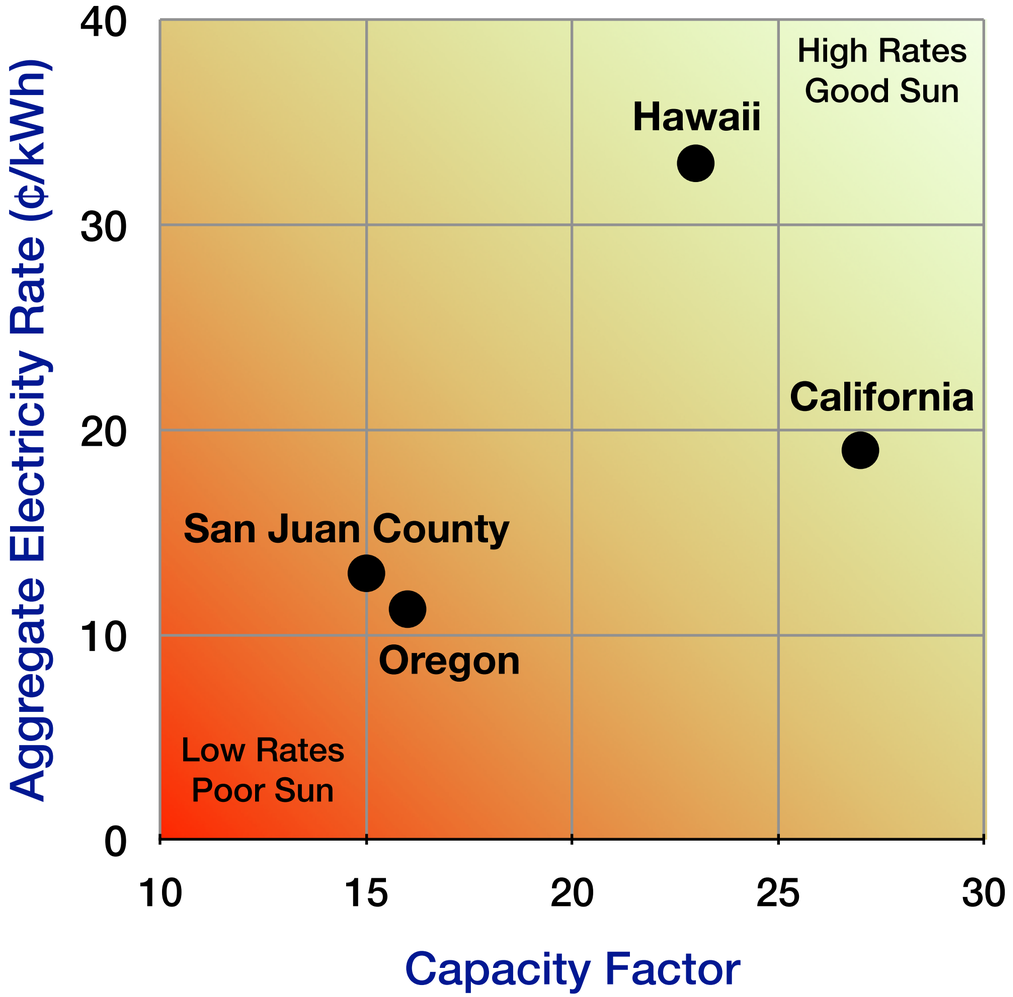
IRP Themes

2020–2025	2025–2030	2030–2035	2035–2040
Prepare for CETA and Grid Parity Increase… - critical infrastructure resilience - dispatchable load, storage - community solar Direct Member Investment (DMI)… - member storage - community solar CETA and BPA contract prep Grants, RESP, DMI, build equity	**Regional Power Risk** CETA Risk Multipliers - reduced capacity, reliability - increasing demand Grid Parity: ramp up utility-scale solar + storage CETA Compliance BPA contract negotiation Grants, RESP, DMI, build equity	**Electrify Everything** Most members drive EVs and heat with heat pumps Electric ferries ramp up Local renewables expand All town centers and critical infrastructure are resilient CETA Compliance Grants, RESP, DMI, build equity	**Local Energy Takes Lead** Most energy generated locally BPA as “ultimate backup battery” Tidal energy grid parity - trial small system - ramp up at grid parity CETA transformation complete Grants, RESP, IRECs, build equity

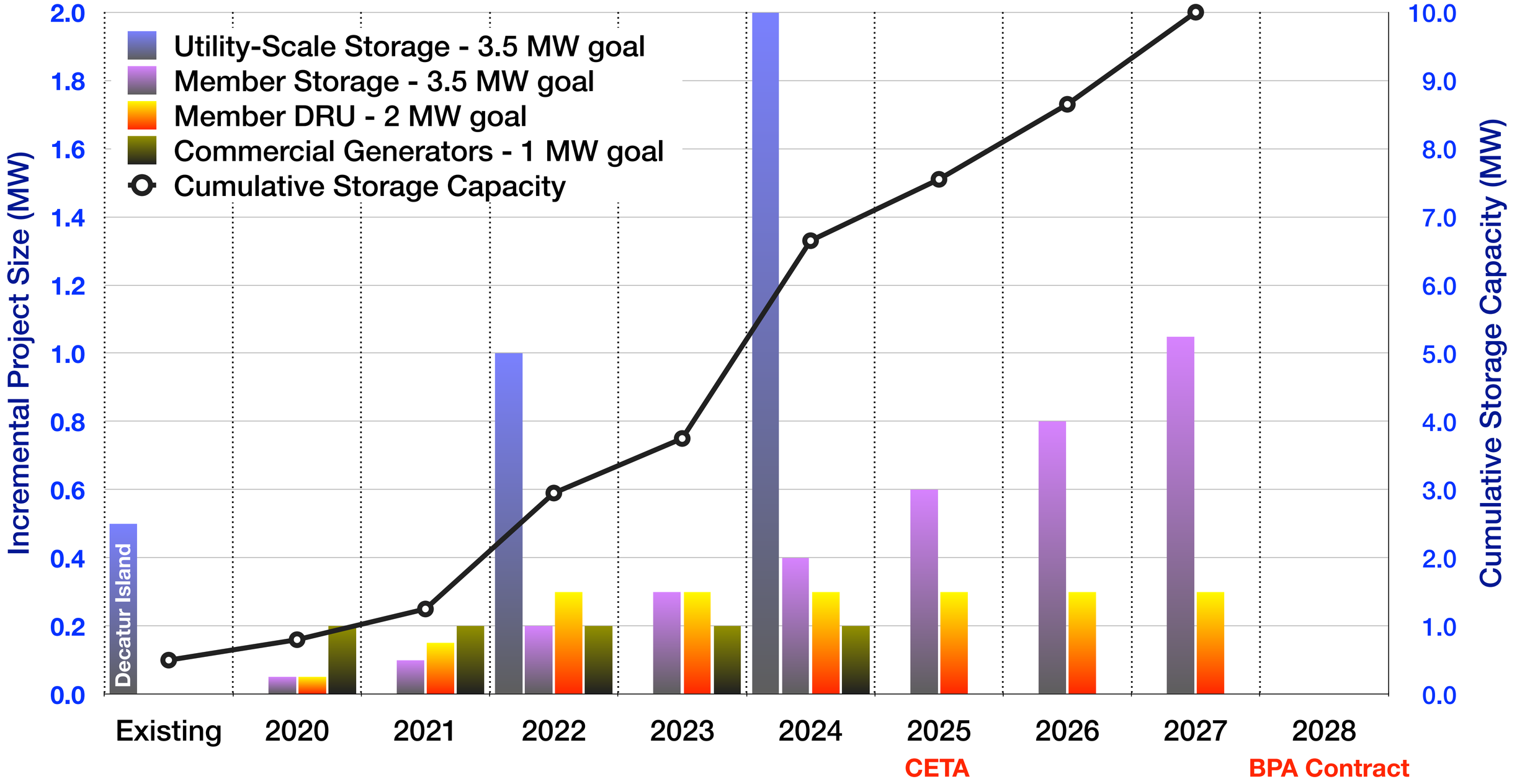
Utility-Scale Solar LCoE Projections (NREL)



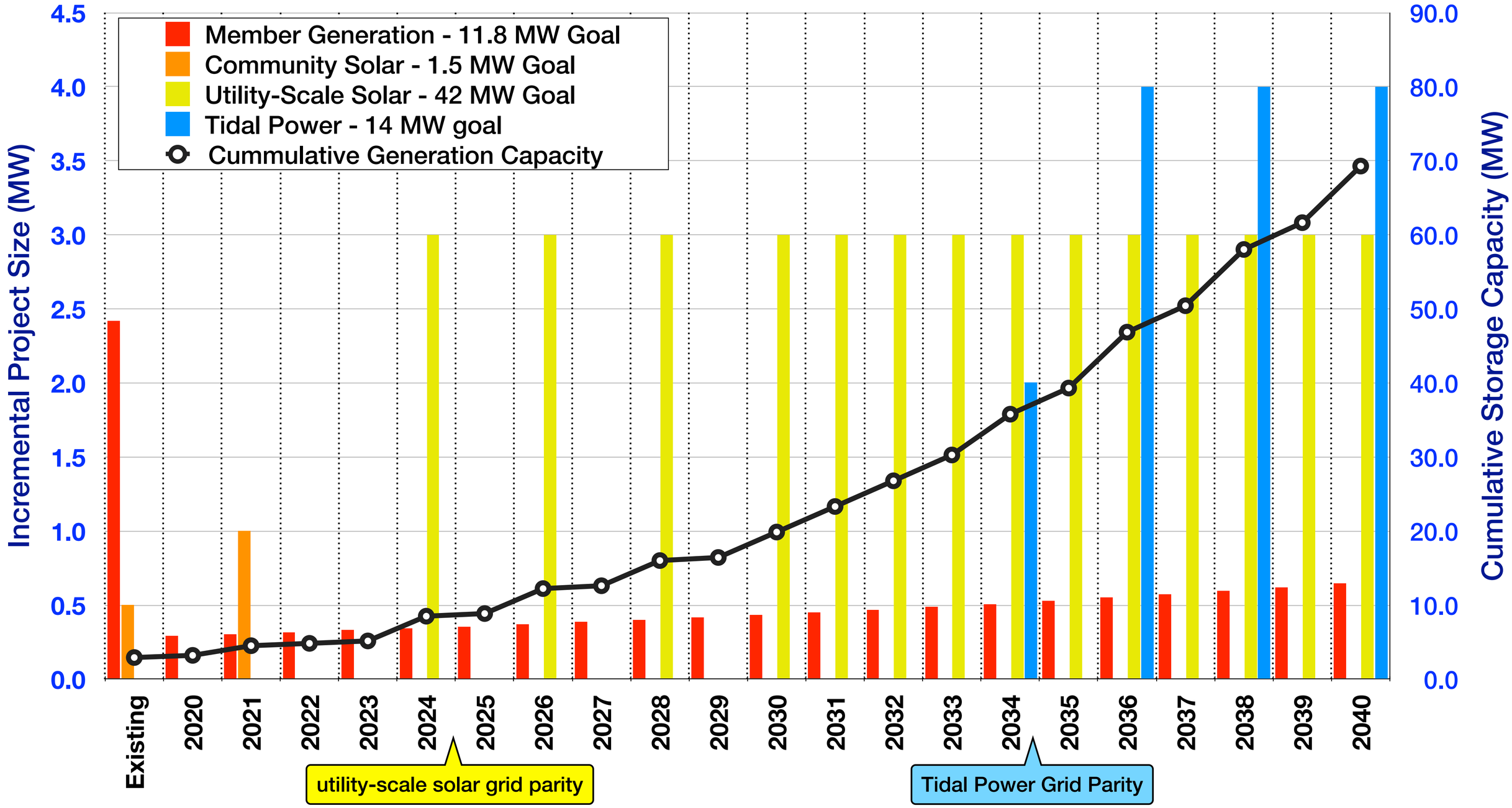
Solar Grid Parity Drivers



Dispatchable Storage Capacity Project Roadmap



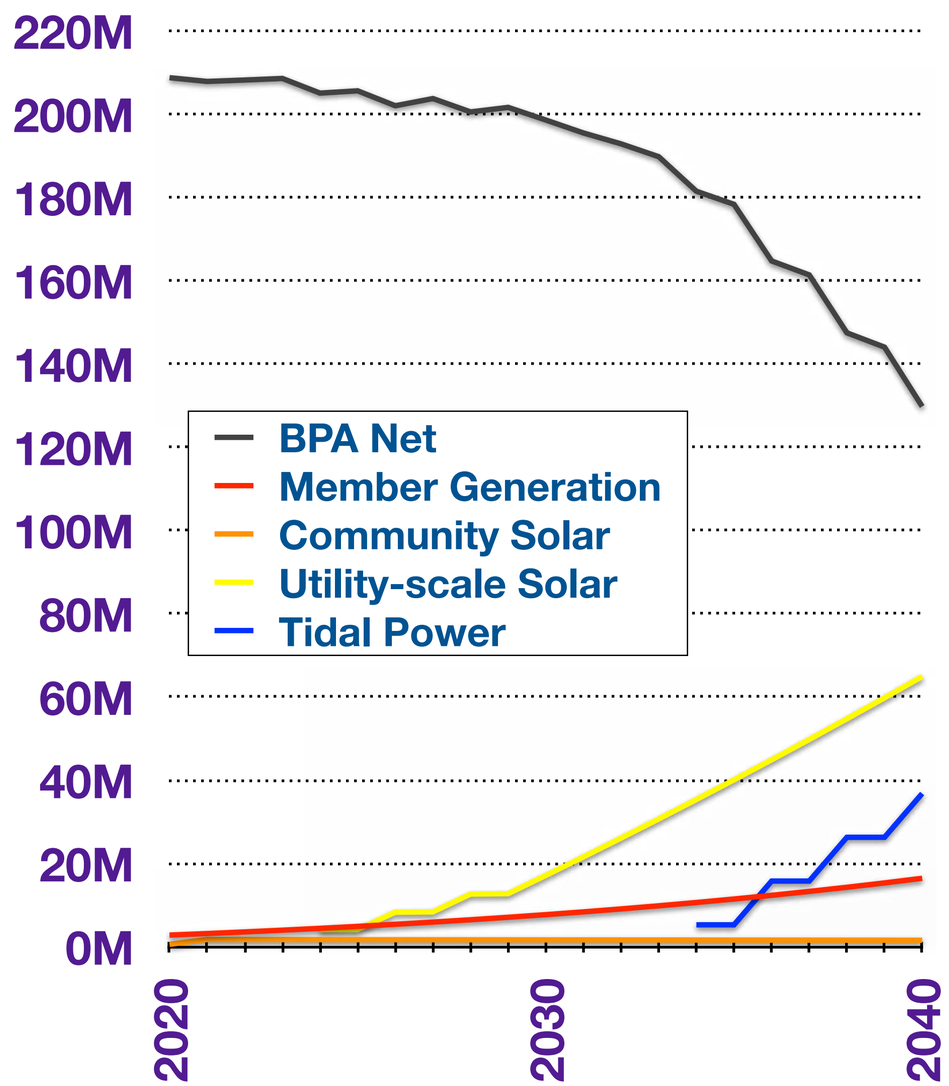
Local Generation Capacity Project Roadmap



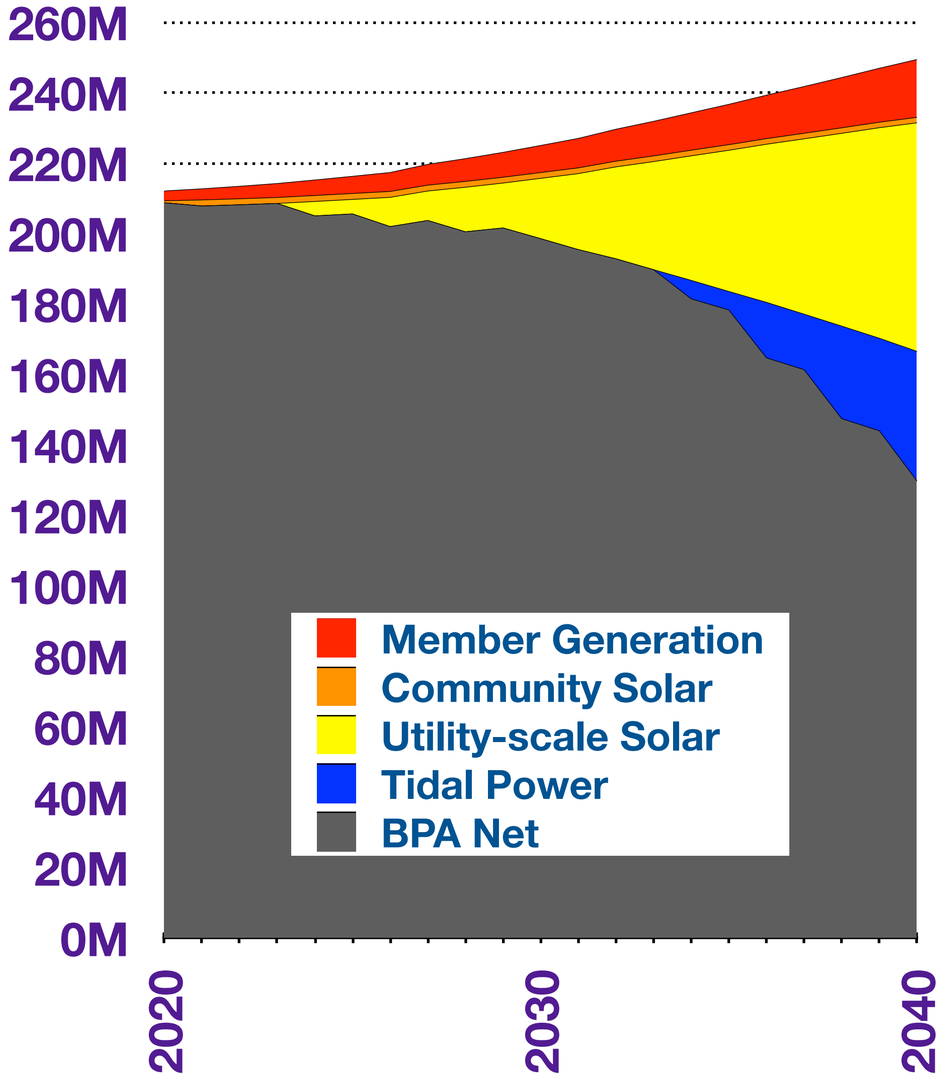
BPA + Local Generation Energy Forecast

BPA + Member Generation (solar, wind, micro-hydro) + Community Solar + Utility-scale Solar + Tidal

Resource Components (kWh)

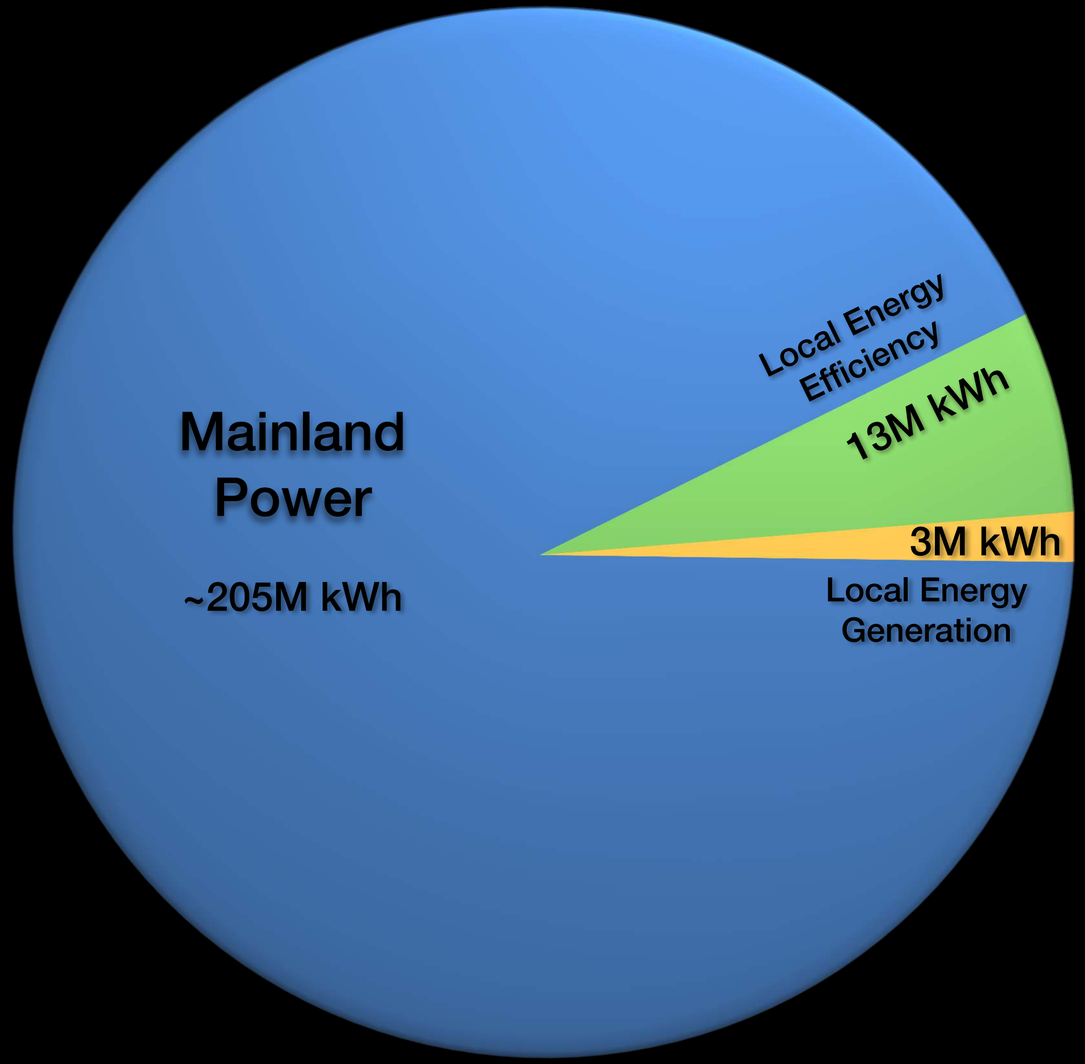


Resource Composite (kWh)

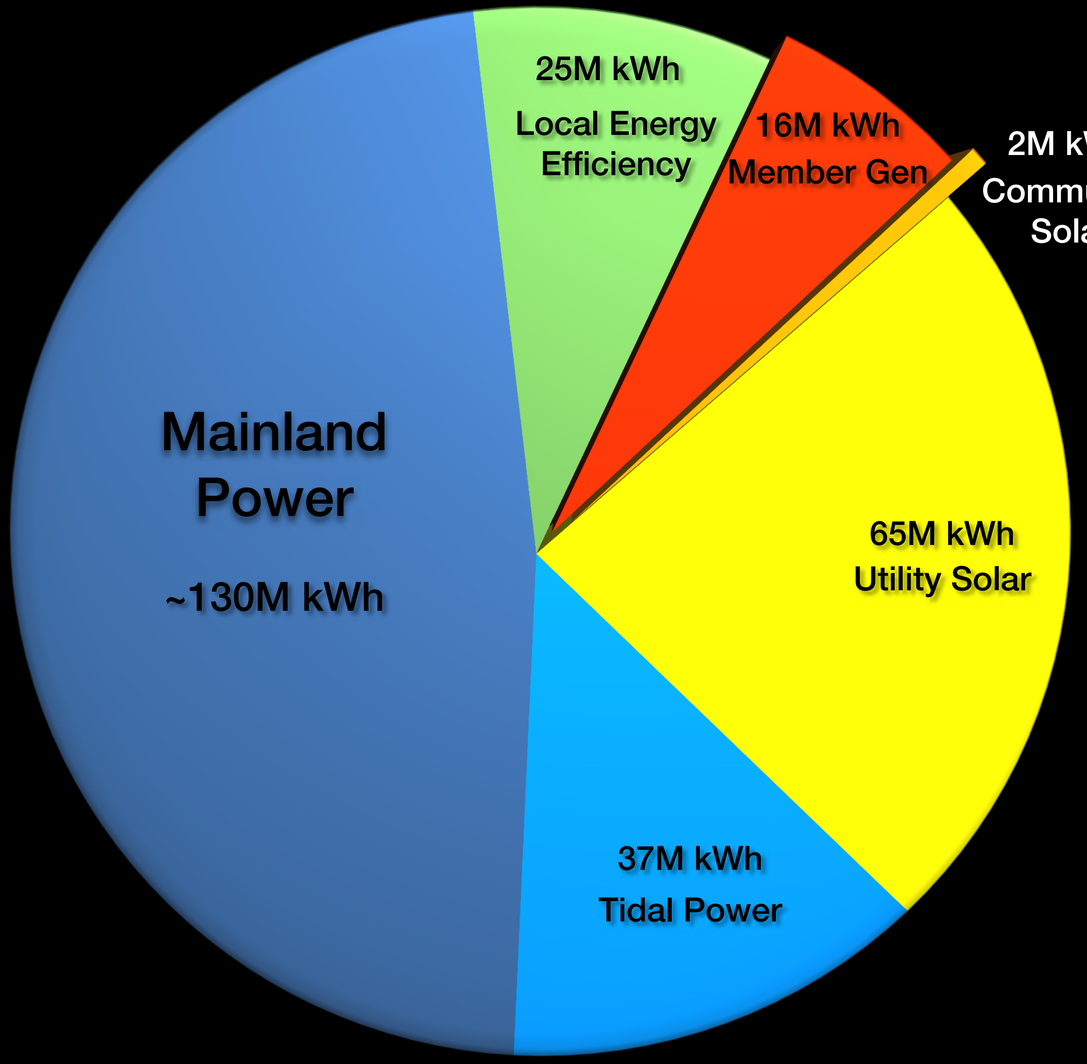


IRP Highlights: Energy Resource Mix

2020 Energy Mix



2040 Energy Mix



Discussion